
ENVIRONMENTAL Fact Sheet



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Tetrachloroethene: Health Information Summary

Tetrachloroethene (also known as perchloroethylene or PCE) is a synthetic liquid chemical. It is used to synthesize other organic chemicals, as a solvent in dry-cleaning clothes, as a metal degreaser, and in the textile industry. Consumer products that may contain PCE include glues, polishes, paint removers, water repellants, rug cleaners and rust removers. Most of the PCE released to the environment goes directly into the atmosphere. PCE in liquid and solid wastes may be released to land and surface water where it readily migrates to groundwater. PCE degrades slowly in groundwater and may remain there for months to years. Under low oxygen conditions in groundwater, PCE may degrade to the more toxic chlorinated chemicals trichloroethene (TCE) and vinyl chloride. The odor threshold for PCE in water is reported to be 0.3 parts per million (ppm); the reported odor threshold in air is 1.0 ppm.

Health Effects

Absorption/Metabolism

In one animal inhalation study, the absorption rate was about 50 percent. Studies with animals indicate that PCE is almost completely absorbed by the oral route. The results of animal studies also indicate that dermal absorption of PCE can be significant, although less important than oral and inhalation absorption. In the majority of studies, at least 90 percent of absorbed PCE was eliminated by the body within three days. The remainder may take up to a few weeks to be eliminated because of PCE's temporary storage in fat tissue.

Short-Term (Acute) Effects

At high inhaled concentrations, PCE acts as an anesthetic, depressing the central nervous system. Exposure to high concentrations by inhalation has caused headache, dizziness sleepiness and muscle spasms. Exposure to PCE at high concentrations can also cause heart arrhythmia as it makes the heart sensitive to the effects of the heart-stimulating hormone epinephrine.

Liver lesions have been noted in animals exposed by inhalation to PCE, while animals orally exposed had increases in liver weight, liver enzyme activity, and lesions of the liver.

Long-term (Chronic) Effects

Workers exposed to PCE via inhalation reported symptoms of dizziness and forgetfulness. The central nervous system effect of a significant delay in reaction times was observed in workers exposed by inhalation to PCE for an average duration of 10 years.

In an occupational study, mildly toxic liver effects were noted in dry cleaning workers employed for an average of 20 years. Liver effects were noted in a 13 week animal study with an inhalation

exposure concentration of 400 ppm. Degeneration of the liver was observed in a two year animal study with an inhalation exposure of 100 ppm.

There have been several studies conducted of workers to determine if exposure to PCE affects the kidneys. Some studies did not find any effects, in others, mild changes in proteins found in the urine were detected.

Reproductive/Developmental Effects

Mixed results have been found in studies of women exposed occupationally to PCE. Some have indicated that an association may exist between exposure and menstrual disorders as well as spontaneous abortions. Other studies have not found an increase in spontaneous abortion.

Rat pups orally exposed to PCE for one week beginning at 10 days after birth resulted in hyperactivity when they were adults. Hyperactivity was also noted in rats that were exposed via inhalation during gestation. These studies are an indication that the developing nervous system may be a sensitive target. Oral exposure to PCE during pregnancy caused no live rat pups to be born at the highest dose and reduced the number born at the next lowest dose. A reduced number of live births were also observed in each of three generations of a multi-generation reproductive study with PCE exposure by inhalation.

Carcinogenic (cancer-causing) Effects

The current evidence from human exposure studies is inadequate to associate exposure to PCE with cancer.

Animal studies in which PCE exposure was by inhalation found an increase in liver cancer in mice and increased leukemia incidence in rats. In a cancer study with oral PCE exposure, an increase in liver cancer was found in mice.

The EPA is in the process of reviewing and updating the health risks of PCE exposure, including its carcinogenic potential to humans. Because there is some evidence that PCE acts to cause cancer in rats and mice in ways that do not apply to humans, the question remains whether the cancers seen in animal studies after PCE exposure are relevant to humans. PCE's cancer classification under the old EPA cancer guidelines as falling somewhere between a Group B or "probable" and a Group C or "possible" human carcinogen has been withdrawn pending the completion of a toxicological review of this chemical.

Health Standards and Criteria

The EPA has established a Maximum Contaminant Level Goal (MCLG) of zero parts per billion (ppb = micrograms per liter or ug/l) for PCE in public drinking water systems. MCLGs are health-based non-enforceable guidelines and have traditionally been set at zero for "known" and "probable" human carcinogens. The EPA has also established a Maximum Contaminant Level (MCL) for PCE. MCLs are enforceable drinking water standards determined by balancing the adverse health effects of a particular chemical against the feasibility and costs of treating contaminated water. The MCL for PCE is 5 ppb.

Because PCE is considered a potential human carcinogen, there may be some degree of carcinogenic risk even below the MCL. Based upon current information of PCE's carcinogenic potential, the EHP estimates that drinking water containing 5 ppb PCE would be associated with an increased lifetime risk of cancer of five in one million (five excess cancer cases in 1,000,000 people exposed). This estimate is based on a daily intake of two liters of water per day for 70 years.

The Occupational Safety and Health Administration (OSHA) enforceable standard for PCE in workplace air, a permissible exposure limit or PEL, is 100 ppm averaged over an eight hour workday.

For more information, please contact the DES Environmental Health Program, 29 Hazen Drive, Concord, NH 03302-0095; (603) 271-4608.

Suggested Reading and References

Casarett and Doull's Toxicology: The Basic Science of Poisons, Sixth Edition. Klaassen, C.D., ed. McGraw-Hill Publishing Co., Inc., New York, 2001.

Toxicological information on tetrachloroethylene. Integrated Risk Information System (IRIS). U.S. EPA, Office of Health and Environmental Assessment. Last major revision 3/88.

Toxicological Profile for Tetrachloroethylene (Update). Agency for Toxic Substances and Disease Registry (ATSDR). Atlanta, GA. September, 1997.

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